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Accumulated Temperatures above 50°F in Southern England

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Introduction

This brief note has been written as a result of a very interesting recent article by I B Cowan in Farmers Weekly on the possibility of maize production in southern England. The article discussed temperatures in England and Wales in this context, and included a map showing accumulated temperatures above 50°F during the growing season, based on a 30 year period; lines of equal value on this map are stated to be for sea level, and corrections for higher ground call for deductions of one day degree per foot for heights above 100 ft. Several points arise from the article which merit discussion.

Analysis

It was not thought worth while at this stage to do full-scale analysis of the data, but just to do sufficient to bring out salient points.

It is not clear what the growing season is intended to be, nor which 30 year period has been taken as stanard, but if the most recent standard period of 1931-60 is considered, and the growing season be defined as March to September inclusive, then totals of approximately 1520 and 1270 emerge for Wisley and Rothamsted, fairly close to the values plotted on the map. Possibly the standard period for the map is 1921-50, which would give rise to very similar figures to 1931-60.

It is, however, pointed out that these values were obtained from the actual temperatures reported from Wisley (150 ft. above sea level) and Rothamsted (420 ft above sea level). The differences between the figures for these two places for the growing season which are assessed in this note (250) and those in Cowan's article (232) are very similar, and obviously no "correction" has been made to the Rothamsted (or Wisley) figures in the Farmers Weekly map to obtain a sea-level value by allowing one day degree per foot of height. The point is made because the map purports to show contours reduced to sea-level, but both the Wisley and Rothamsted values have been more or less drawn to as though they were at sea level - certainly no upward correction of 300+ has been made for Rothamsted for example.

Variability from one standard period to another

The figures given below are approximate and relate to two periods: the latest "standard"temperature period of 1931-60 and the last 20 years 1949-68.

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Table 1

ACCUMULATED TEMPERATURES ABOVE 50°F AT WISLEY AND ROTHAMSTED

Station	Period of Calculation	Accumulated Temperatures above 50°F for:					
		Spring	Summer	Autumn	Winter	Year	March-September
Wisley	1931-60	200	1070	360	10	1640	1520
	1949-68	180	1010	360	10	1560	1430
Rothamsted	1931-60	140	920	290	0	1350	1270
	1949-68	120	870	290	0	1280	1200

At both Rothamsted and Wisley the total yearly accumulation in the last 20 years is about 6% less than over the standard period 1931-60. Which is the better, more representative, period to take is, of course, a moot and very important question but there is considerable evidence to suggest that springs and summers of the 1930s and 40s are amongst the warmest in the last 200 years. It might therefore be that the lower figures of 1949-68 are the more representative - certainly they would be the more prudent to consider.

Variability from one year to another

The annual figures for the distribution of the accumulated temperatures above 50°F do not constitute a statistically normal distribution, so standard deviations have not been calculated. However, Table 2 below constitutes a 47 year period for Wisley and presents the annual figures in decades to show the variation; the pattern would be very similar for growing seasons - or for spring and summer together.

/Table 2

Table 2

DISTRIBUTION OF ANNUAL ACCUMULATED TEMPERATURES ABOVE 50°F FOR WISLEY FOR DECADES FOR 1921 ONWARDS

Accumulation	Period (1900+)					Total
	21-30	31-40	41-50	51-60	61-69	
1100+					62	1
1200+	22				65	2
1300+		31		54 56	63	4
1400+	23 24 25 27	39	46		66 67	8
1500+	28	32 36 40	41 44 48	53 60	68	10
1600+	26 29 30	35 37 38	42 43 50	51 52 55 57 58	61 64	16
1700+		34			(69)	2
1800+			45			1
1900+		33		59		2
2000+	21		47			2
2100+			49			1
						49

Results are summarized in Table 3.

Table 3

PERCENTAGE DISTRIBUTION OF YEARS EACH DECADE FROM 1921 WITH VALUES OF ANNUAL TEMPERATURE ACCUMULATIONS ABOVE 50°F AT WISLEY BELOW CERTAIN VALUES

Decade	Percentage Distribution of years with Accumulations below:							
	1300	1400	1500	1600	1700	1800	1900	2000
1921-30	10	10	50	60	90	90	90	90
31-40	0	10	20	50	80	90	90	100
41-50	0	0	10	40	70	70	80	80
51-60	0	20	20	40	90	90	90	100
61-69	22	33	56	67	89	100	100	100
Average	6	14	31	51	84	88	90	94

The value for 1969 in Table 2 was estimated. Values for the growing season (if March to September) will be 110-120 less than totals for whole years, and this should be borne in mind in considering Table 3; in particular, in 1969 October was very warm, and the difference for 1969 would have been over 200.

Without going into detail, it is clear from the above tables that only two values in the last 20 years or so are much above the 1931-60 average of 1640, and 7 were well below. In the period 1931-60, 5 would have been well above and 5 well below average.

Method of Calculation

The author describes the calculation of accumulated temperatures as the day's average temperature -50. This is of course only true if the night temperature does not fall below 50°F, as one is concerned only with temperatures above 50°F and a table or formula allows for night temperatures below 50°F. Values in the article appear correct, and this was probably a slip of the pen in the article.

Variation with height

It is not proposed at this junction to cite a definite value for correction with height but experience suggests that a figure of 50 day degrees F per 100 ft of height (or possibly even less) would be nearer than the suggested value of 100 day degrees F per 100 ft of height. Differences between Rothamsted and Wisley (270 ft in height) are of the order of 230 to 250 in the supposed growing season, and of this difference, probably something like 100 would be explained by difference of exposure in the two stations, and perhaps to latitude difference. Clearly the difference between accumulations at different heights cannot be as great as 100 day degrees F 100 ft, otherwise at places like Buxton (more than 1000 ft above sea level) there would be next to no accumulation above 50°F even in the summer half of the year.

Conclusions

This brief note is an attempt to outline one or two cautions which need to be expressed regarding Cowan's map. The general run of the contours west/east over the British Isles for the growing season is roughly correct, but the detailed configuration in southern England will probably not stand up to close examination. The standard period of analysis is not stated, but it is almost certainly for a period with materially higher temperatures than the last 20 years - especially the last 10 years. Whether this is a good thing, this writer is not prepared to give an opinion, other than to state that the temperatures would almost certainly be representative of the top quarter or half of the spectrum.

It will be realized that little has been done here than to survey the problem, and to do a great deal more in the preparation of a really satisfactory map for example would involve considerable effort, but if there is real demand for something of this sort, it will be tackled. If therefore any reader of this note does feel it might be worth while, then it would be appreciated if he can indicate the type of analysis, whether 50°F is a suitable datum level and whether monthly analysis over the spring/summer half of the year would suffice or whether autumn (or in particular September) should also be introduced.

Bibliography

Cowan I B - 1969. Hot enough for Maize?
Farmers Weekly 3.10.69. pp xvi-xvii.

Any comments or suggestions on this paper should be sent to the author.

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